NOTES FOR STUDENTS

Infection as related to humidity and temperature.—The importance of humidity and temperature in relation to infection has long been known to plant pathologists. The problem, however, has been taken up once more by LAURITZEN[2] in a study of diseases caused by *Puccinia graminis* on wheat, *Ascochyta fagopyrum* on buckwheat, and *Colletotrichum lindemuthianum* on red kidney bean.

The apparatus used consisted of two double-walled chambers, each provided with heating coils, thermostats, and thermoelectric connections to furnish heat and power to run the fans. The outer wall of each chamber was made of glass, the inner of wood except the lids (which were of glass), the wood portions being coated with paraffin of a high melting point to prevent absorption of water. Evaporation surface for the control of humidity was furnished by pans containing either water or saturated salt solutions. No attempt was made to control light, after experiments designed to test its relation to infection had given negative results. Carbon dioxide is thought to have been of little or no importance in the experiments, since the experimental chambers were not so tight but that gaseous exchange was possible between inside and outside whenever temperature variations occurred. Pure line strains were used in the case of all 3 of the fungi, but only of wheat in the case of the hosts. Plants of the same age and spores of the same age were used as far as possible, although there was some unavoidable variation in both cases.

The author uses as a criterion by which to judge the effect of temperature and humidity the percentage of plants infected out of the total number exposed to infection. He thus avoids most of the objections which have been made to the criteria used by other workers. Where they have measured the effect of temperature and humidity (on the fungus alone) by the rate of extension of the germ tube and development of the mycelium, by the time required for germination of spores, or by the percentage of germination, he measures it by a criterion which takes account of fungus and host as well.

The lower temperature limit for infection of wheat by *Puccinia* was found to be about 42° F.; of buckwheat by *Ascochyta* about 45° F.; and of bean by *Colletotrichum* about 57° F. The upper temperature limits in the 3 cases were respectively 80, 100, and 80° F. The range of humidity (relative) for infection of wheat varied between 92 and 100 per cent; of bean, between 92 and 100 per cent; of buckwheat, between 90 and 100 per cent. In no case did he find the temperature ranges for host and parasite identical. The temperature range for growth of bean and wheat is wider than that for the germination of spores of an infection by *C. lindemuthianum* and *P. graminis*. The upper temperature limit for the growth of bean is higher than that for germination of spores of and infection by *C. lindemuthianum*, a fact which has made possible

[2] LAURITZEN, J. T., The relation of temperature and humidity to infection by certain fungi. Phytopathology **9**:1–35. 1919.

the control of anthracnose in the southern states. The exact temperature range for *Ascochyta* and buckwheat was not determined.

Results obtained by other workers have shown that there is no definite optimum for infection, but that there is a wide range of temperature in which, providing some other factor does not interfere, the number of infections taking place does not vary much if the plant is exposed to infection for a sufficient length of time at the lower temperatures. These earlier results are borne out by the work of LAURITZEN. He concludes, therefore, that in considering control measures we must note not only the temperature which seems favorable to infection, but also the length of time for which the plant has been exposed.

The results he obtains from a study of the effect of humidity on infection lead him to point out that "the absence of certain diseases in semi-arid and arid regions where agriculture has been practised for long periods of time may be due in part to the small moisture content of the air," and that "seasonal variation in the moisture content of the air plays an important part in determining the amount of disease that develops." Because of the rather general belief that a film of moisture on the leaf surface favors infection, it is interesting to note the conclusion reached by the author that such a film is not essential. He considers it proved that, within certain limits of humidity, the spore is able to absorb sufficient water for germination, at first by imbibition and later by osmosis. He suggests also that in depressions of the leaf surface, especially above the stomata, the humidity may be high enough to make germination possible.—D. H. ROSE.

Life history and sexuality of Basidiomycetes.—Miss BENSAUDE[3] has investigated *Coprinus fimentarius*, *Armillaria mucida*, and *Tricholoma nudum*. The work includes two phases: (1) the morphology and cytology of the mycelia, and (2) the results obtained from the study of the single spore cultures of *C. fimentarius*.

The mycelia of the 3 species were obtained from germinating spores as well as from material collected in the field. The author accepts FALCK'S classification of the mycelia into primary, secondary, and tertiary forms. The claim is made that the first few days after the germination of the spores the resulting mycelia belong to the primary class, in which the hyphae are partitioned off into cells which contain from one to many nuclei. These uninucleate cells may give rise to varying numbers of uninucleate oidia. Disarticulated hyphal cells, which she calls "pseudoidia," are also formed which, like true oidia, may germinate. The nuclei in the germ tubes divide amitotically. Cross-walls with clamp connections never appear in the hyphae of the primary mycelia. Miss BENSAUDE grew single spores of *C. fimetarius* in pure cultures, and succeeded in isolating 10 single spores. Of these, 4 germinated, and in 2

[3] BENSAUDE, MATHILDE, Recherches sur le cycle évolutif et la sexualité chez les Basidiomycètes. Dissertation. pp. 156. *pls. 13. figs. 30.* Nemours. 1918.